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(54) IMPROVEMENTS IN COIN-RELEASED GAMING MACHINES

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By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of PETER SIMPER AND COMPANY LIMITED, a British Company, of PO Box 43, Milk Street, Bath BA1 1UU.

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Page 1, line 4, *after* EDMUND BULL *insert* and IAN BRUCE

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SPECIFICATION NO 1454046

By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of PETER GRAY SIMPER, ROGER JOHN GATLEY, ALBERT EDWARD JOHN HARDY and IAN BRUCE all British Subjects, trading as PETER SIMPER & COMPANY, of PO Box 43, Milk Street, Bath BA1 1UU.

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(72) Inventor ROGER JOHN GATLEY

(54) IMPROVEMENTS IN COIN-RELEASED GAMING MACHINES

(71) We, PETER GRAY SIMPER, ROGER JOHN GATLEY, ALBERT EDWARD JOHN HARDY and LEONARD EDMUND BULL, all British subjects trading as PETER SIMPER & COMPANY, of P.O. Box 43, Milk Street, Bath BA1 1UU, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is performed, to be particularly described in and by the following statement:—

This invention relates to a coin-released gaming machine of the kind in which the pay-out means is at least partially random, such as a fruit machine, and is concerned with the provision in such a machine, of a means for controlling the short-term pay-out ratio of the machine.

The term 'pay-out ratio' is intended to mean the value of prizes paid out by the machine divided by the value of the coins inserted into the machine to release the machine for games in which those prizes were won. The prizes may be other than coins.

The word 'coin' is intended to include a token.

The pay-out ratio of a fruit machine averages out over long periods to a steady amount determined by the arrangement of the pay-out mechanism of the machine, and by the average ability of machine players when the winnings are partially determined by the skill of the player. When a machine is played for a few hours each day the pay-out ratio may not average out to a very steady value until a period of perhaps several months or so is considered. Over short-term periods of a few hours, a few days or even a few weeks the pay-out ratio may vary considerably from the long-term value, simply by a chance run of wins or lack of wins, or owing to the differing skills of various players.

It is known to incorporate manually operable switches within a fruit machine cabinet which can be set by the proprietor or operator of the machine to alter the level of the long-term pay-out ratio for the time being to a higher or lower amount according to his requirements.

The object of the invention is to provide a means for controlling the pay-out ratio over the short-term, that is to say, reducing the possibility of the occurence of large runs of wins or runs of games in which there is no win.

An important advantage gained from stabilising the short term pay-out ratio is that an improved security check may be carried out on a machine since it is very unlikely that the overall pay-out ratio will vary by more than a predetermined amount unless the machine has been tampered with.

According to the invention a coin-released gaming machine of the kind set forth incorporates means for controlling the short-term pay-out ratio of the machine comprising means monitoring the total value of coins paid in, means monitoring the total value of prizes paid out and means responding to departure of the ratio of the two values from a predetermined ratio and acting to alter the chance or value of the prizes paid out in a subsequent game or games in a direction such as to tend to correct the ratio of the total values.

When the machine accepts only coins of a particular denomination and the payout is also in those coins, the ratio of the two values is equal to the ratio of the numbers of coins paid out to those inserted, and the monitoring means may simply comprise counters. When the pay-out is not in coins of the same denomination the actual values of the prizes received relative to the values of the coins inserted should be taken into account in computing the pay-out ratio.

Preferably the subsequent game in which the chance or value of the prizes is altered is the immediately succeeding game, and the ratio of the two values is re-computed after or during each game so that the most up-to-date information is used for controlling the pay-out ratio. A very large win during a single

game may necessitate immediate action to reduce the pay-out ratio temporarily during succeeding games.

The pay-out may be influenced in any convenient manner to increase or decrease the pay-out ratio. The value of prizes paid out for a given winning combination of symbols may be varied, or the chance of a prize being paid out may be varied in any convenient manner.

Preferably the chance of a prize being paid out is altered by varying the amount of control which a player can exert on the symbols that determine whether or not a prize is obtained.

In a preferred arrangement the chance is altered by affecting the ability of a symbol to be held from one game to a subsequent game, but many other ways may be visualised. For example, the ability of a reel of a fruit machine to be advanced by one or more symbols may be altered.

Means may be provided to allow the predetermined ratio to be manually adjusted.

The total values of coins paid in and prizes paid out by the machine may be compared with the predetermined ratio in any convenient manner. For example, the ratio of the two values for the time being may be computed and the difference between the current ratio and the predetermined ratio may be used as a control to alter the payout in subsequent games.

Preferably, however the total values are proportioned by the predetermined ratio and the accumulated difference between the proportioned values obtained is used to alter the payout. Use of the accumulated difference means that the entire history of the operation of the machine is used for influencing the current pay-out ratio.

The payout mechanism of the machine is preferably arranged to be operable in a plurality of modes in each of which there is a different chance or value of prizes being paid out, and switching means is incorporated responsive to the departure of the ratio of the total values from the predetermined raio for switching the machine from one mode to another.

There may be only two modes corresponding to long-term pay-out-out ratios which are respectively above and below the predetermined ratio, but preferably the machine is adapted to operate in three modes corresponding to long-term pay-out ratios which are respectively less than, greater than, and yet greater than the predetermined ratio.

Depending on the degree of control that it is desired to exercise on the short-term pay-out ratio there may be more than three modes.

In a preferred arrangement the ratio of the total values is compared with the predetermined ratio by a device comprising two ratchet mechanisms responsive respectively to the value of coins inserted into the machine and to the value of prizes paid out, the ratchet mechanism being connected through respective reduction gearing and a common differential drive to an angularly movable cam assembly arranged to operate at least one switch for altering the chance or value of prizes being paid out, the arrangement being such that if the electro-magnetic ratchet mechanism were to receive pulses in the predetermined ratio the cam assembly would maintain a fixed position.

Gaming machines normally incorporate meters to record the number of coins inserted into the machine and the total value of prizes paid out. This enables the operator of a machine to keep a check of the average pay-out ratio over the period between readings of the meters. If a machine operating in accordance with the invention is tampered with so as to obtain excessive pay-outs over a short period of time this would normally not be apparent from the meter readings, since action would be taken by the controlling means to reduce the level of pay-outs during the succeeding games to compensate for the excessive pay-outs during the period of tampering.

Preferably, therefore, additional means are included for de-energising either or both of the monitoring means at least temporarily in response to a persistent departure of the ratio of the two values from the predetermined ratio. This prevents the controlling means subsequently providing complete compensation for the pay-outs obtained during the period of tampering. The pay-out ratio as calculated from the meter readings will then lie outside the normal range of control of the controlling means to provide a strong indication of tampering.

According to another aspect of the invention a coin-released gaming machine of the kind set forth incorporates means for controlling the short-term pay-out ratio of the machine comprises means for computing an accumulated difference between the value of coins which would have been paid out over a short period at a desired long term pay-out ratio and the value of prizes actually paid out, and means responsive to the accumulated difference for influencing the short term pay-out ratio of the machine so as to keep the accumulated difference to a minimum or within a predetermined range.

The invention will now be further described, by way of example only, with reference to the accompanying drawings in which:—

Figure 1 is a plan view of the comparator unit showing the two ratchet wheels, ratchet mechanisms for advancing the respective ratchet wheels, and solenoids for actuating the respective ratchet mechanism in response to coins inserted into the gaming machine and to coins paid out;

Figure 2 is a partial side elevation of the comparator unit, looking in the direction of

the arrow A in Figure 1 and with the ratchet mechanism and switches omitted, showing details of the gearing between one of the ratchet wheels and the cam assembly which actuates two comparator switches for adjusting the pay-out means.

Figure 3 is a partial front elevation of the comparator unit, looking in the direction of the arrow B in Figure 1 and with the ratchet mechanism and ratchet wheels omitted together with two of the comparator switches;

Figure 4 is a section on the line 2—2 of Figure 3 and showing the reduction gearing;

Figure 5 is an under-plan view of the comparator unit showing two comparator switches used for de-energising the ratchet solenoids, and the lower end of the axle to which the cams are fixed at its other end; and

Figure 6 is a simplified circuit diagram of a hold-control circuit of a fruit machine incorporating the cam-actuated comparator switches for affecting the chance of a person being able to hold a symbol from one game to the next.

Referring to Figures 1 to 6 the comparator unit has a rigid chassis 1 comprising a pair of parallel rectangular plates 2 and 3 spaced apart by four hollow posts 4 with screws 5 extending through the posts to secure corresponding legs 6 for mounting the unit in a fruit machine.

Two ratchet wheels 7 and 8 are connected by similar reduction gearing 9 and 10 and a differential gear assembly 11, shown generally in Figure 3, to a cam assembly 12 arranged to operate a pair of microswitches 13 and 14 for effecting the hold-control circuit of a fruit machine.

The ratchet wheels 7 and 8 are secured to the upper ends of identical respective shafts 15 and 16 journalled in the plates 2 and 3. As shown in Figure 2 the shaft 16 is geared down to an intermediate shaft 17 journalled in plates 2 and 3 by means of two co-operating gears 18 and 19 having 12 and 30 teeth respectively to effect a reduction of 2/5. The intermediate shaft 17 has a pinion 20 secured to it and co-operating with a gear 21 of the differential gear assembly 11. The pinion 20 and gear 21 have 12 and 70 teeth respectively so that a further reduction of 6/35 is effected.

The gear 21 of the differential gear assembly 11 is free to rotate on a shaft 22 to which the cam assembly 12 is secured, but is fixed to a bevel gear 23 which co-operates with a bevel pinion 124 rotatable on a stub 25 secured to the shaft 22. The differential gear assembly 11 effects a reduction of 1/2 between the gear 21 and the shaft 22 when a further bevel gear 24 identical to gear 23 and co-operating with the bevel pinion 124 is held stationary with respect to the chassis.

Thus a total reduction of 6/175 is effected between the shaft 16 carrying the ratchet wheel 8 and the shaft 22 carrying the cam assembly.

A similar gear train effects an identical reduction between the shaft 15 carrying ratchet wheel 7 and the shaft 22. Shaft 15 is geared to an intermediate shaft 26 through the co-operation of gears 27 and 28, shown in Figures 3 and 4 and corresponding respectively to gears 18 and 19, and the intermediate shaft 26 is geared to the bevel gear 24 by means of a pinion 29 co-operating with a gear 30 fast with the gear 24 but free to rotate on shaft 22.

Each of the shafts 15, 16, 17, 22 and 26 is secured against substantial axial movement by suitable shoulders on the shafts and by the disposition of the various gearwheels so that each of the pairs of gearwheels are permanently engaged with one another.

The arrangement of the gears is such that rotation of the two ratchet wheels 7 and 8 in opposite directions and by equal amounts results in zero rotation of the shaft 22 carrying the cam assembly 12, but if one ratchet wheel is rotated more than the other ratchet wheel the difference in the amounts of rotation is transmitted to the shaft 22 but reduced by a factor of 6/175.

The ratchet wheels 7 and 8 are arranged to be stepped in opposite directions by identical respective ratchet mechanisms 31 and 32, in Figure 1, mounted upon the upper chassis plate 2.

The ratchet mechanism 31 comprises a ferromagnetic arm 33 pivoted at one end on a post 34 upstanding from the plate 22 and pivotally connected at its free end to a ratchet detent 35 spring biassed in a counter-clockwise direction about the pivotal connection with the arm by a coil spring 36 which also biasses the arm 33 in a counter-clockwise direction about the post 34. The coil spring 36 is anchored to a post 37 upstanding from the plate 2 and passes around a further fixed post 38 which forms a stop to prevent radially outward movement of the free end of the ratchet detent 35 relative to the ratchet wheel 7. A further ratchet detent 39 is provided on the post 37 and is urged counter-clockwise about the post into engagement at its free end with teeth of the ratchet wheel 7 by a further spring 13 anchored to a fixed post 40.

A solenoid 41 is mounted upon the plate 2 and when energised by an electrical pulse attracts the arm 33 towards it so as to retract the free end of the ratchet detent 35 by one tooth of the ratchet wheel 7 whilst the wheel is held by the detent 39. When the pulse is completed the arm 33 is released and the spring 36 moves the arm 33 counter-clockwise about the pivot 34 until the free end of the detent 35 is trapped between post 38 and the ratchet wheel 7 and the arm is arrested by a fixed post 43. This has the effect of

advancing the ratchet wheel 7 in a counter-clockwise direction. The detent 39 overrides a tooth of the ratchet wheel as it is advanced, and then retains the wheel in its new position. Thus the ratchet wheel is advanced by one tooth in a counter-clockwise direction each time solenoid 41 is energised.

The ratchet mechanism 32 is constructed and operates in an identical manner in response to pulsing of a corresponding solenoid 42, except that the ratchet wheel 8 is stepped in a clockwise direction.

The solenoids 41 and 42 are intended to be pulsed in response respectively to coins inserted into the machine and to coins paid out. The ratchet wheels 7 and 8 have 50 and 39 teeth respectively in this example which is intended for a fruit machine having a normal long-term payout percentage of 78%. If after a relatively small number of games the total payout has amounted to 78% of the coins inserted into the machine then the solenoids 41 and 42 will have been pulsed in the ratio 50:39 and so the cam assembly will have maintained its initial position. However if the solenoids have not received an accumulated number of pulses in this ratio then the cam assembly will have been angularly moved from its initial position.

The cam assembly 12 comprises two cam plates 43 and 44 of identical profile in plan but angularly displaced from one another by a few degrees about the axis of shaft 22 to which they are adjustably secured by set screws 45 passing through bosses 46 rigid with the respective cam plates. As shown in Figure 1 each cam plate comprises a sector 47 of a circle of larger radius and a sector 48 of smaller radius the profiles of which are joined by steps 49 which are inclined with respect to a radius of the cam plate.

The microswitches 13 and 14 are of the kind sold under the trade name 'UNIMAX', type No. 2TMGT20-4. Each is provided with a pivoted switch arm 50 sprung outwardly by a resiliently biassed switch actuating button 51 and having a rounded nose 52 at its free end for co-operation with its associated cam plate. The nose 52 of the switch 13, as shown in Figure 3 co-operates with the upper cam plate 43 whereas the nose of the switch 14 co-operates with the lower cam plate 44.

The switches are positioned such that when the cam assembly 12 is in the position shown in Figure 1, symmetrically arranged with respect to the ratchet wheels 7 and 8, each of the noses 52 of the switches lies against the sectors 48 of the cam plates of smaller radius. Rotation of the cam assembly 12 by a few degrees in either direction from this position causes one or other of the switch noses 52 to be engaged by a step 49 of the cam and the associated switch actuating button 51 to be depressed as the nose 52 moves onto the part of the cam-plate of larger radius. The other switch will remain in the same condition during this angular movement of the cam assembly in one direction. If the cam assembly is displaced angularly in the other direction then the other microswitch will be actuated.

Thus the arrangement of the cams and switches gives rise to three conditions of the switches; a first condition in which switch 13 is actuated with switch 14 unactuated, a second condition in which switches 13 and 14 are unactuated, and a third condition in which switch 14 is actuated with switch 13 unactuated. These three conditions can be used to control the chances of a person obtaining a payout from the fruit machine since the position of the cam assembly is determined by the numbers of coins that have been paid out by the machine relative to the number of coins that have been inserted by the machine player.

Referring now to Figure 5 of the drawings the lower end of the shaft 22 for the cam assembly 12 carries a boss 53 through which two stop-members 54 in the form of screws are secured to retain the boss and stop-members fixed to the shaft 22. If the shaft 22 becomes angularly displaced by an excessive amount in either direction then one of the stop-members 54 actuates the appropriate one of a further pair of limit switches 55 and 56 mounted on the underside of the lower plate 3, the switches being used to open-circuit the excessively pulsed coil as will be explained hereinafter.

The three conditions of the switches 13 and 14 may be used in various ways to control the chances of a person obtaining a payout during subsequent plays of the mechanism.

The first, second and third conditions of the switches 13 and 14 are preferably arranged to correspond respectively to first, second and third modes of the payout mechanism in which the long-term pay-out ratio is respectively less than, greater than, and much greater than the desired 78%. That is, if the machine were to operate continuously in the first mode, for example, the pay-out ratio calculated for a long-period of time would be less than 78%.

If there has been a chance run of wins then the cam assembly will have been displaced to a clockwise position corresponding to the first condition of the switches and a low long-term pay-out ratio. During succeeding games the chance of winning will be reduced so that the cam assembly will gradually, but in a random manner, become displaced clockwise until the switches change to their second condition. The chance of a pay-out will then be increased since the pay-out will switch to operating in the second mode, and the cam assembly will normally then begin to turn back in an anti-clockwise direction. Thus the

cam-assembly will normally home to the position of switching between the first and second conditions of the switches.

If when the switches are in their second condition, however, the player through ill-luck or bad judgement continues to achieve pay-outs corresponding to a pay-out ratio less than 78% then the cam assembly will continue to turn in an anti-clockwise direction and the switches will eventually change to the third condition. In this condition the pay-out ratio is arranged to be much greater than 78% so that the player can win with ease. Owing to the resulting wins the cam assembly will then turn back in a clockwise direction so that the machine will change to operating in the second mode, and the cam assembly will then home to the position of switching between the first and second conditions of the switches.

If there is a fault in the machine, or if the machine has been tampered with the compensatory effect may not be sufficient to maintain the cam assembly within its normal working range. If the shaft 22 and assembly continues to be displaced in one direction then ultimately one of the switches 55 or 56 is actuated. This is preferably arranged to de-energise temporarily the appropriate coil, 41 or 42, that has been excessively pulsed to prevent the cam assembly 12 from becoming overrun. As previously explained this will also prevent the comparator unit from compensating fully for excessive or inadequate payouts obtained during a period of tampering. Readings of meters which record the total value of coins inserted into the machine and prizes paid out will then show that the pay-out ratio has departed from the range of control exerted by the comparator unit. When tampering ceases the cam assembly 12 will turn back from its extreme position so that switch 55 or 56 will be de-actuated to re-energise the open-circuited coil, and the comparator will resume normal operation. The meter readings thus will give a strong indication that the machine has a fault or has been tampered with. However, owing to chance it may still be possible for a coil to be pulsed excessively even when compensatory action has been taken by the unit to alter the chances of winning.

In the unit described above the cam assembly comprises a pair of cam plates for co-operation with two micro-switches to give three conditions of the switches. Two cam plates have been used to enable adjustment of the positions of shaft 22 which correspond to actuation of the switches 13 and 14. It will be appreciated that many modifications may be made in this arrangement. For example the two cam plates may be replaced by a single composite plate for co-operation with both switches, or there may be only a single switch.

The unit gives rise to three conditions of the payouts of the machine: low, high and very high chances of payouts. In a simple machine it might be possible to use only two conditions of the payout. On the other hand more than three conditions of the payout may be controlled by a suitable unit employing a different cam assembly with possibly more than two micro-switches operated by it.

Figure 6 shows a simple circuit incorporating the switches 13 and 14 to demonstrate how the comparator unit described above may be used to affect the ability of a person to a reel of a fruit machine having three reels from one game to the next and thereby affect his chances of winning. The usual hold-control circuit has been simplified in Figure 6 as will be appreciated by persons skilled in the art. For example the circuits which allow cancellation of a hold have not been shown since these are not relevant to the way in which the odds are affected by the comparator unit.

The circuit is one which may enable a player to hold any one of three symbols chosen by him from one play to the next. If the player is allowed to hold then any one of the three reels may be held.

Two supply lines 57 and 58 are fed from a mains transformer 58'. The right, centre and left reels of the fruit machine may be held by a respective one of solenoids 59, 60 and 61 which are arranged to be respectively energised by switches 62, 63 and 64 of right, centre and left hold relays to be described. Energisation of a solenoid allows its associated reel to rotate.

The right reel solenoid is connected by a lead 65 to the supply line 57 and by a lead 66 to the upper contact of switch 62. Similarly the centre and left reel solenoids 60 and 61 are connected by leads 67 and 69 to the supply line 57 and by leads 68 and 70 respectively to the upper contacts of hold relay switches 63 and 64. The hold relay switches 62, 63 and 64 are respectively connected by leads 71, 72 and 73 to the supply line 58. The lower terminal of each of the switches 62, 63 and 64 is connected to a lead 74 connected to one side of a hold control relay 75 the other side of which is connected by a lead 76 to the supply line 57. The hold control relay is energised when any of the hold relay switches 62, 63 or 64 is in its lower position in which the associated solenoid is de-energised to hold the associated reel. The hold control relay has a self-energising circuit, not shown, to maintain the relay in the same state from one game to the subsequent game.

The hold relay switches 62, 63 and 64 are associated respectively with right, centre and left hold relays 77, 78 and 79 arranged to be respectively energised by right, centre and left hold switches 80, 81 and 82 in the form of control buttons accessible to the machine player. The ability of the machine player to

energise any of the hold relays 77, 78, 79 is determined by a switch 83 of a random relay.

The right, centre and left hold relays are respectively connected on one side to the supply line 57 by leads 84, 85 and 86 and have their other sides respectively connected by leads 87, 88 and 89 to the lower contacts of hold switches 80, 81 and 82 respectively. The upper contact of the right hold switch 80 is open-circuited and its other contact is connected by a lead 90 to the upper contact of centre hold switch 81. The centre hold switch 81 is connected by a lead 91 to the upper contact of left hold switch 82 and that switch is connected by a lead 92 to the lower contact of the switch 83 of the random relay. The centre contact is connected by lead 94 to supply line 58.

The arrangement of hold switches 90, 91 and 92 is such that any one of the hold relays 77, 78 and 79 may be energised by operation of the appropriate switch 90, 91 or 92 provided the relay switch 83 is closed.

Whether or not a player is allowed to hold a reel is determined by whether or not the random relay 95 is energised. The chances of the random relay being energised is determined by an appropriate one of three random hold cam switches 96, 97 and 98, and which cam switch is operative is determined by the state of the switches 13 and 14 of the comparator unit and of the state of the hold control relay 75, as will now be explained.

The random hold cam switches 96, 97 and 98 comprise three shaped cams fixed to a common spindle, not shown, which is driven by a common motor M. The cam of switch 96 is arranged such that at any one time there is an 80% chance of the associated switch member being in the position shown in the drawing in which it co-operates with the upper switch contact 99, and such that there is a 20% chance that the switch member will co-operate with the lower switch contact 100.

Cam switches 97 and 98 are arranged to have chances of 58% and 75% respectively of being in a closed condition rather than in an open condition as shown in the drawing.

One side of the random relay 95 is connected by a lead 101 to the supply line 57 and its other side is connected by a lead 102 to the comparator switch 13 which is shown in Figure 6 in its non-actuated condition corresponding to the cam assembly 12 of the comparator unit being in a neutral position. The lower contact of the comparator switch 13 is connected by one lead 103 to comparator switch 14. In practice switches 13 and 14 shown in Figure 6 may, of course, be the contacts of relays controlled by the switches on the comparator units. The upper contact of switch 14, which is shown in the condition corresponding to a neutral position of the cam assembly 12, is connected by a lead 104 to the lower contact of the random cam switch 97. The lower contact of switch 14 is connected by a lead 105 to a switch 106 controlled by the hold control relay 75. The upper contact of switch 106 is connected by a lead 107 to the lower contact of random cam switch 98 and by a lead 108 to the upper contact of random cam switch 96.

The upper contact of comparator switch 13 is connected by a lead 109 to a further switch 110 controlled by the hold control relay. The switch members of switches 110 and 106 are shown in the positions they occupy when the hold control relay 75 is de-energised. The upper contact of switch 110 is connected by a lead 111 to the lead 104, and the lower contact of switch 110 is connected by a lead 112 with the lower contact 100 of the random hold cam switch 96. The lower contact of switch 106 is connected by a lead 113 with the lead 104.

Random cam switches 96, 97 and 98 are respectively connected on one side of the supply line 58 by leads 114, 115 and 116.

The comparator switches 13 and 14 give rise to three conditions of the circuit for energising the random relay 95. Two of these three conditions can be associated with either of the two conditions of the switches 110 and 106 controlled by the hold control relay. Thus there are five conditions of the energising circuit in total. The different conditions will determine which terminal of which random hold cam 96, 97 or 98 is connected to the lead 102 connected to the random relay to determine the chance of the random relay being energised.

The table shows for the different combinations the chances of the random hold relay being energised to allow a reel to be held.

When the cam assembly is in the position shown in Figure 1 following a period when the payouts have averaged out at less than the desired 78% long-term pay-out percentage then the switch members of comparator switches 13 and 14 are in the positions shown in Figure 6 corresponding to said second condition, and the random relay is connected by leads 102, 103 and 104 with the lower contact of the random hold cam switch 97. As previously stated there is a 58% chance that the switch 97 will be closed. This circuit is made irrespective of whether or not the hold control relay is energised, and therefore the chance of the player being able to hold one of the reels is 58% whether or not a reel was held during the previous play of the machine. This is the second mode of the pay-out and corresponds to a long-term pay-out greater than 78%.

If the cam assembly has been displaced clockwise owing to a run of wins the comparator switch 13 will be actuated so that its switch member makes contact with the upper contact of the switch. If the hold control relay is energised so that switch 110 is in the con-

dition shown in Figure 6 a circuit exists from the random relay via leads 102, 109, 111 and 104 to the lower contact of random hold cam switch 97 so that the chance of random relay 95 becoming energised is again 58%, as shown in the table. However, if a reel has been held during the preceding play the hold control relay 75 will be energised so that the switch member of switch 110 provides a connection between lead 109 and lead 112 and the lower contact 100 of the random cam switch 96. There is only a 20% chance that the contact 100 will be energised by switch 96 to energise the random relay 95. Thus the chance of holding after a hold in the preceding game is only 20% and this corresponds to the first mode of the pay-out mechanism in which the long-term pay-out ratio is less than 78%.

If the cam assembly has been displaced anticlockwise owing to a run of bad luck by the player, or to his poor skill in the use of the hold buttons on the machine, the switch 14 will be in the condition in which a circuit is made from lead 103 to lead 105, and the switch 13 will connect leads 102 and 103. With the hold contol relay de-energised switch 106 will be in the condition shown in Figure 6, and a circuit will exist from the random relay 95 via leads 102, 103, 105, 107 to the lower contact of random hold cam switch 98 and also via lead 108 to the upper contact of random hold cam switch 96. The two contacts of the switches 96 and 98 result in a chance of 80% and 75% combined giving an overall chance of approximately 90% depending on the overlay of the two cams. Thus there is a 90% chance of the player being able to hold a reel when the cam assembly is in this position, but with the hold relay de-energised. This corresponds to the third mode of the pay-out mechanism in which the long-term pay-out ratio is much greater than 78%.

If the hold relay is energised following a hold in the preceding play switch 106 will connect leads 105 and 113 so that a circuit exists from random relay 95 via leads 102, 103, 105, 113 and 104 to the lower contact of the random hold cam switch 97. Thus the chance of the random relay being energised to enable a reel to be held is again 58%.

In the lower part of Figure 6 are shown the circuit elements for energising the coils 41 and 42 of the comparator unt. The coil 41 of the comparator unit is connected on one side by a lead 117 to the supply line 57 and on its other side by a lead 118 to normally closed comparator switch 55 which is connected by a lead 119 to a switch 122 responsive to the insertion of a coin or to a play of the machine. The circuit for the coil 41 is completed by a lead 120 connected to the supply line 58.

The coil 42 is energisable by a similar circuit including normally closed comparator switch 56 and a payout switch 121 which is pulsed for each coin that is paid out by the machine. If the shaft 22 and cam assembly 12 become excessively angularly displaced in either direction then switch 55 or switch 56 will be actuated to open-circuit the corresponding coil 41 or 42, as previously mentioned.

It will be appreciated that the comparator unit described above computes a difference between the numbers of coins inserted into the machine and those paid out, after those numbers have been proportioned by the desired long-term pay-out ratio. Moreover the cam assembly adopts a position determined by its previous position as modified by the number of coins paid out during a game. That is, the angular position of the cam assembly corresponds to an accumulated difference, and the action which is taken to correct the pay-out ratio uses the accumulated difference as a control.

Since the cam assembly adopts a position determined by the accumulated difference its angular position at any time will correspond to the excess or deficiency of coins paid out over those paid in as compared with the numbers of coins which would have been paid out had the machine been operating constantly at the predetermined ratio. Thus a given position of the cam assembly corresponds to a given excess or deficit of coins. Since action is taken automatically to maintain the cam assembly within its operating range this excess or deficit of coins will normally lie within a predetermined range irrespective of the period of operation of the machine.

This provides a very sensitive security check on the operation of the machine.

TABLE

Position of cam assembly 12 as viewed in plan in Fig. 1.	Chance of holding	Chance of holding after a hold in preceding play of machine
cam assembly displaced clockwise (reduced long-term payout ratio — first mode of payout)	58%	20%
cam assembly in neutral position (increased long-term payout percentage — second mode of payout)	58%	58%
cam assembly displaced anticlockwise (further increased long-term payout percentage — third mode of payout)	90%	58%

WHAT WE CLAIM IS:—

1. A coin-released gaming machine of the kind set forth incorporating means for controlling the short-term pay-out ratio of the machine comprising means monitoring the total value of coins paid in, means monitoring the total value of prizes paid out and means responding to departure of the ratio of the two values from a predetermined ratio and acting to alter the chance or value of the prizes paid out in a subsequent game or games in a direction such as to tend to correct the ratio of the total values.

2. A machine as claimed in claim 1 in which the subsequent game in which the chance or value of the prizes is altered is the immediately succeeding game.

3. A machine as claimed in claim 1 or claim 2 in which the ratio of the two values is re-computed immediately after or during each game.

4. A coin-released gaming machine as claimed in any of the preceding claims in which the total values are proportioned by the predetermined ratio and the accumulated difference between the proportioned values obtained is used to alter the chance or value of the prizes paid out in a subsequent game.

5, A coin-released gaming machine as claimed in any of the preceding claims in which the chance of a prize being paid out in a subsequent game is altered by varying the amount of control which a player can exert on the symbols that determine whether or not a prize is obtained.

6. A coin-released gaming machine as claimed in claim 5 in which said chance is altered by varying the chance of a symbol being able to be held from one game to a subsequent game.

7. A coin-released gaming machine as claimed in any of the preceding claims in which the machine is adapted to be operated in a plurality of modes in each of which there is a different chance or value of prizes being paid out, and switching means is incorporated responsive to the departure of the ratio of the total values from the predetermined ratio for switching the machine from one mode to another to correct the ratio of total values.

8. A coin-released gaming machine as claimed in Claim 7, in which the machine is adapted to operate in at least two modes comprising a first mode in which the long-term pay-out ratio is less than the predetermined ratio and a second mode in which the long-term pay-out ratio is greater than the predermined ratio.

9. A coin-released gaming machine as claimed in Claim 8, in which the machine is adapted to operate in a third mode in which the long-term pay-out ratio is greater than that in said second mode.

10. A coin-released gaming machine as

claimed in Claim 3, in which the ratio of the total values is compared with the predetermined ratio bv a device incorporating gears.

11. A coin-released gaming machine as claimed in claim 10 in which the device comprises two electromagnetic ratchet mechanisms responsive respectively to the value of coins inserted into the machine and to the value of prizes paid out, the ratchet mechanisms being connected through respective reduction gearing and a common differential drive to an angularly movable cam assembly arranged to operate at least one switch for altering the chance or value of prizes, the arrangement being such that if the electromagnetic ratchet mechanism were to receive pulses in the predetermined ratio the cam assembly would maintain a fixed position.

12. A coin-released gaming machine as claimed in claim 11 in which the electromagnetic ratchet mechanisms each include a toothed ratchet wheel, and the ratio of the numbers of the teeth on the two wheels is equal to the predetermined ratio.

13. A coin-released gaming machine as claimed in claim 11 or claim 12 in which the cam assembly or its drive is provided with means for de-energising one of the ratchet mechanisms when that mechanism has been excessively operated to cause the came assembly to become angularly displaced beyond its normal operating range.

14. A coin-released gaming machine as claimed in any one of the claims 1 to 10 incorporating means for de-energising at least temporarily either or both of the monitoring means in response to a persistent departure of the ratio of the two values from the predetermined ratio.

15. A coin-released gaming machine of the kind set forth incorporating means for controlling the short-term pay-out ratio of the machine comprising means for computing an accumulated difference between the value of coins which would have been paid out over a short period at a desired long-term pay-out ratio and the value of coins actually paid out, and means responsive to the accumulated difference for influencing the short-term pay-out ratio of the machine so as to keep the accumulated difference to a minimum or within a predetermined range.

16. A coin-released gaming machine of the kind set forth incorporating means for controlling the short-term pay-out ratio of the machine substantially as described with reference to and as shown in Figures 1 to 5 of the accompanying drawings.

17. A coin-released gaming machine as claimed in claim 16 and substantially as described with reference to Figure 6 of the accompanying drawings.

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1454046 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

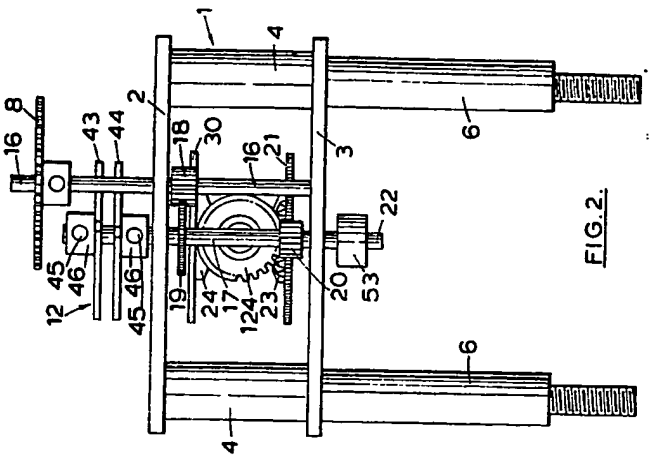

FIG.2.

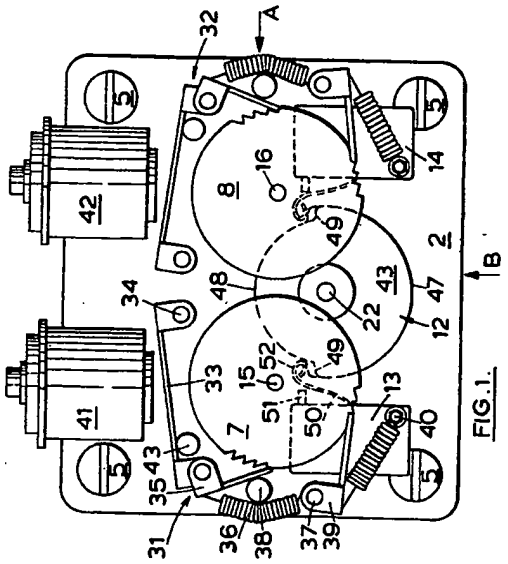

FIG.1.

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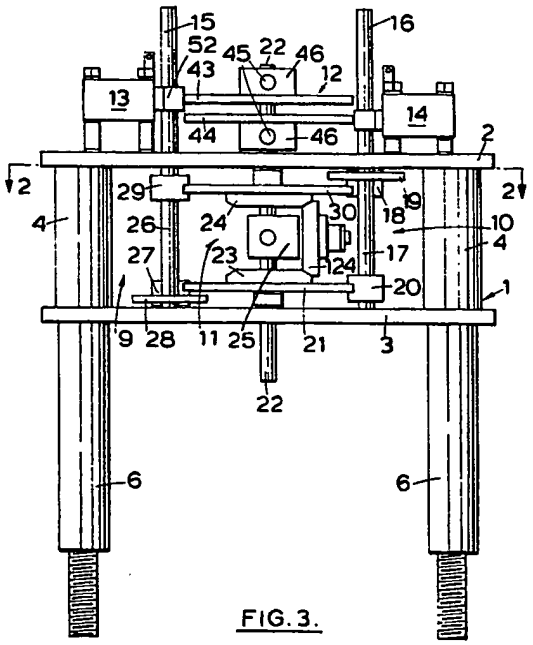

FIG. 3.

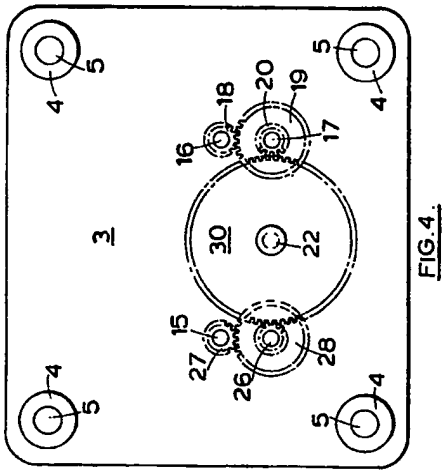

FIG.4.

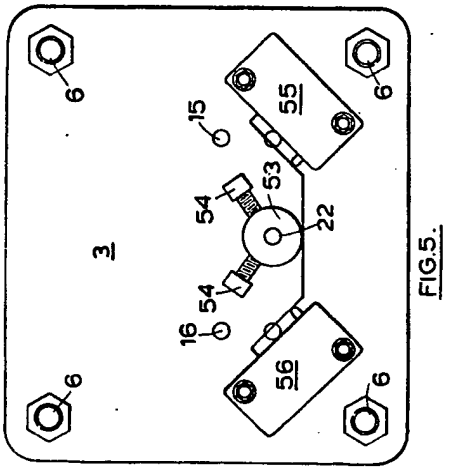

FIG.5.

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FIG. 6.